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# LOADRITE LOAD WEIGHING SYSTEM

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*The Loadrite System read-out control box in the cab of a log loader*

## INTRODUCTION

Ascertaining the weight of logs loaded onto a logging truck at a skid is a problem all trucking contractors have to contend with. To optimise the load size, yet remain within the on-highway axle weight regulations, is mostly left to the driver's judgement, but overloading or underloading can have severe economic consequences. Various methods have been developed overseas to monitor load weight, such as on-board truck scales or portable load ramps. None have proved overly popular in New Zealand.

A weight measuring device, called the Loadrite weighing system, has now been developed in N.Z. by Wilton Associates, Tauranga, in association with Actronic Systems Ltd., Auckland. It can be fitted to any hydraulic bucket or log loader. The first prototype tests were carried out on a quarry-based gravel loader, and proved highly satisfactory in this closely controlled situation. It was then decided to test the concept on a log loader in the forest. This report explains the concept and summarises the setting up and results of the study.

*ACKNOWLEDGEMENTS*

*LIRA acknowledges the co-operation of the following organisations: Logging Division, Waipa Sawmill; Wilton Associates, Tauranga; Actronic Systems Ltd., Auckland; and the private truck owners who participated in the study.*

## SYSTEM DESCRIPTION

The Loadrite system electonically converts hydraulic pressure into a weight read-out. This is achieved by fitting a transducer into the main lift ram hydraulic supply line. Once the system has been calibrated under set conditions, (i.e. stationary machine, constant engine revs, forks crowded back, and the same lift position) any additional pressure in the system is then created by the load. This pressure is electronically converted into a weight reading and displayed on a digital read-out in the control box, situated in the cab of the loader. After each fork load has been weighed the accumulated load is displayed on a second read-out by simply depressing a push button on the console or the control lever. Upon completion of a truck load, the system is re-set to zero in preparation for the next truck.

## BACKGROUND SITUATION

In the quarry situation trucks were tared in over a weighbridge, loaded using the Loadrite system to monitor weight, then the full trucks were weighed out over the weighbridge. The advantage of the Loadrite system was that once calibrated correctly the trucksdid not have to return to have some of the load removed or added to make up the optimum weight. This has increased productivity by as much as an additional trip per day in some cases.

The situation is not quite so simple in a logging environment because:

1. The geographical distance between skid and weighbridge means that the truck tare weight can vary, because of such factors as fuel usage, load moisture content, etc.
2. The centre of gravity of a fork full of logs varies, as does the position of the loader's beak, so that there is an inherent weight variation in the operation. This has to be taken into account when designing a monitoring system.

## THE STUDY

The Loadrite system was fitted to a NZFS Hough 90 log loader, operating in Kaingaroa Forest. The unit was loading predominantly Waipa owned trucks hauling Douglas fir logs to Waipa Sawmill, a round trip of approximately 120 kilometres. The study concentrated mainly on the Waipa owned trucks,as the figures were easy to correlate.

After installation the system was calibrated by weighing a series of logs using LIRA's 2.5 tonne proving ring sensor and read-out. These logs were then used in various combinations to check the range of the Loadrite weighing system. (See Figure 1.)

*Figure 1 - Loader fitted with the Loadrite system weighing marked logs previously checked by LIRA*

The loader was in radio contact with Waipa base so that the loaded-out weight and corresponding net weight across the weighbridge could be compared. Only the load was weighed at the skid, but the whole rig was weighed at the weighbridge. The truck tare weight was then subtracted from the total to arrive at the load weight.

Any alteration in the truck tare affects the correlation between the two systems. Figures on the daily fuel usage of the Waipa trucks were also collated to see what affect the fuel weight had on tare weight, and thus net load weight. Trucks were tared every two months with half full fuel tanks and specified accessories. Eack took on average of 200 kilograms of fuel per day, meaning that the tare weight was varying by this figure.

Apart from individual axle loadings, which are dependent upon a number of variables, Ministry of Transport regulations allow a maximum of 5% gross overload on the whole rig. Over 100 trucks were checked in one week, and the results are shown in Figure 2. Less than 5% fell outside the margin allowed by the M.O.T. Analysis of the figures showed that the extreme results were out by a sufficient margin to suggest that the loader operator had inadvertently double added a load weight to the total. This problem has been overcome by removing the push button from the lift control lever, meaning that the operator has to make a definite move to add the weight by pushing the appropriate button on the console. The electronic circuitry has been redesigned and now will not accept double loading figures.

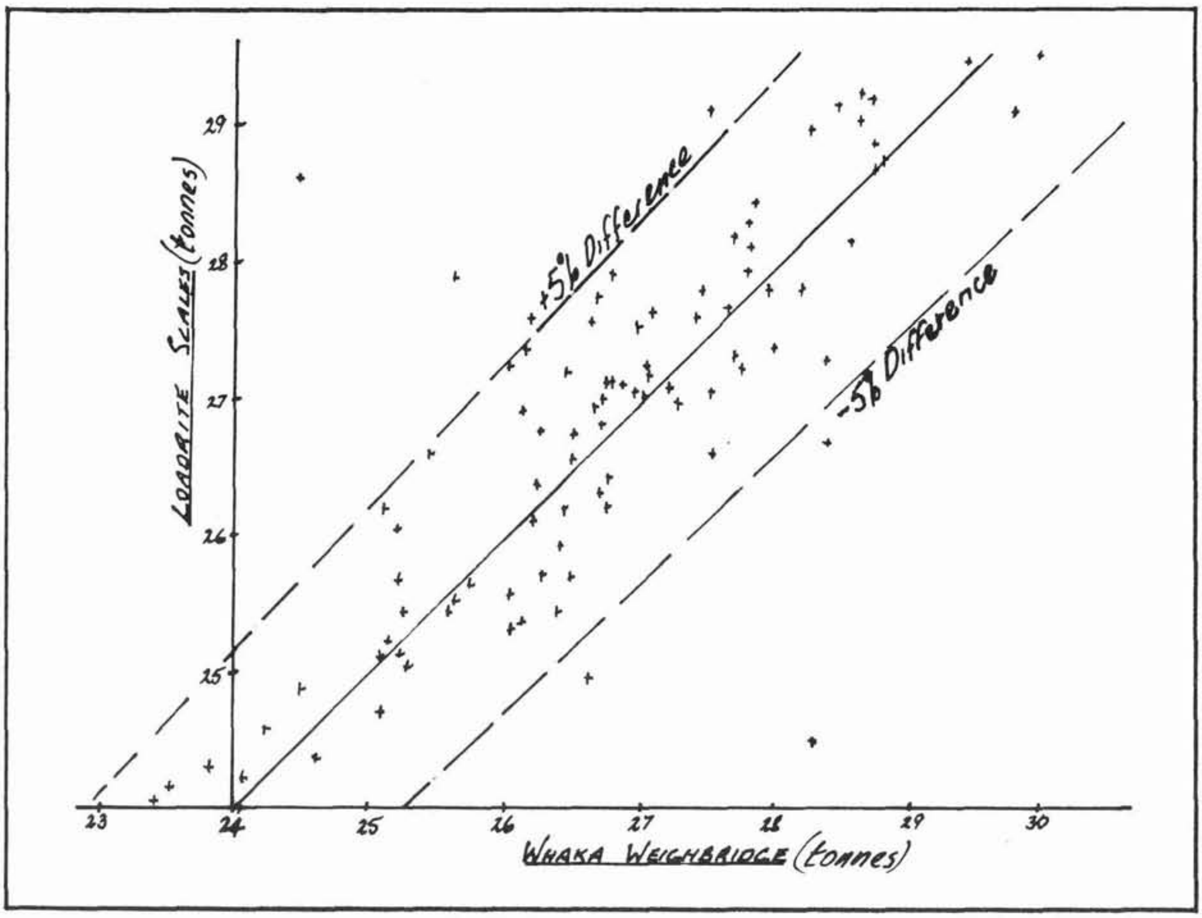


*Figure 2 - Graph of the Whaka weighbridge readout versus the Loadrite system readout*

A table showing a typical days production and comparative weights is shown on Page 4.

In addition, the loading procedure was also timed to check the affect the weighing time delay had on the overall cycle. Average increase for 31 truck loads amounted to 10.83 seconds delay per cycle, or approximately one minute per load. This delay was considered minimal.

| TRUCK NO. | WEIGHBRIDGE | LOADRITE | DIFFERENCE | % DIFFERENCE |
|---|---|---|---|---|
| 1 | 28.32 | 27.28 | -1.040 | 3.67 |
| 2 | 24.05 | 23.02 | -1.030 | 4.28 |
| 3 | 26.26 | 25.70 | -0.560 | 2.13 |
| 4 | 25.59 | 24.92 | -0.670 | 2.62 |
| 5 | 25.23 | 25.43 | +0.200 | 0.79 |
| 6 | 23.84 | 24.32 | +0.480 | 2.01 |
| 7 | 25.57 | 24.85 | -0.720 | 2.82 |
| 8 | 27.35 | 27.59 | +0.240 | 0.88 |
| 9 | 26.98 | 26.97 | -0.010 | 0.04 |
| 10 | 23.52 | 24.18 | +0.660 | 2.81 |
| 11 | 25.28 | 25.04 | -0.240 | 0.95 |
| 12 | 26.22 | 26.37 | +0.150 | 0.57 |
| 13 | 28.49 | 28.14 | -0.350 | 1.23 |
| 14 | 24.23 | 24.58 | +0.350 | 1.44 |
| 15 | 26.25 | 26.77 | +0.520 | 1.98 |
| 16 | 24.07 | 24.22 | +0.150 | 0.62 |
| 17 | 26.10 | 26.91 | +0.810 | 3.10 |
| 18 | 29.96 | 30.57 | +0.610 | 2.04 |
| | 467.31 *(tonnes)* | 466.86 *(tonnes)* | | $\frac{33.98}{18}$ = 1.88% average |

## OBSERVATIONS AND CONCLUSIONS

Based on the results of three days observation and one weeks recording, the following comments can be made:

- the accuracy of this method of determining truck load weight on skid is realistic. An average of less than 2% discrepancy per load, between the Loadrite system and the weighbridge was recorded.
- the Loadrite system is easy to install and operate.
- costing approximately $3,800 per unit, it is far cheaper to equip one loader than the variety of trucks that work from the skid.
- because the system is operator sensitive, care must be taken to follow a standard procedure each time, e.g. ensure that the forks are fully crowded back, engine revs are the same, and the loader stationery.
- time delay caused by the weighing sequence is minimal, and would be negligible if carried out just prior to positioning logs onto the truck.
- the concept could be easily applied to other facets of the timber industry where hydraulic systems are used.
- the system could have distinct cost benefits to small operators or systems where a weighbridge is not conveniently sited in the transport cycle.

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